

Construction Advisory

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From Brenda O'Brien, Engineer of Construction and Technology

MDOT-Construction and
Technology Support Area
P.O. Box 30049
Lansing, Michigan 48909
Phone/517-322-1087
Fax/517-322-5664
www.michigan.gov/mdot/

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Questions regarding this
Construction Advisory
should be directed to:

Dick Endres, Foundation
Analysis Engineer, at
517-322-1207 or
endres@michigan.gov



BJO:RBE

Plan Notes Prohibiting the use of Vibratory Hammers for Installation or Extraction of Sheet Pile or Drilled Shaft Casings

Plans for road, bridge, and traffic signing projects may include notes that prohibit the use of vibratory hammers. Vibratory hammers are prohibited when support soils for adjacent structures, pavements or utilities may be compromised. Vibratory hammers may induce settlement thru dynamic consolidation, or liquefaction of non-cohesive soil strata.

Settlement from dynamic consolidation occurs when vibration triggers a reorientation of the mineral particles in the soil into a more closely spaced arrangement. The reduced volume of the soil matrix causes settlement of structures above.

Liquefaction is a condition where a cohesionless soil will lose its strength and undergo large deformations due to the buildup and maintenance of high pore pressures in the soil. As with dynamic

consolidation, vibrations break the point-to-point particle contact in the soil skeleton, but with liquefaction load is transferred from the soil skeleton to water in the void space surrounding the mineral particles. Water is a fluid. An ideal fluid, by definition, cannot support shear stress. Liquefied soil beneath structures may flow and deform until the pore pressure is relieved and the point-to-point particle contact is reestablished.

Predicting damage from vibrating soil is not an exact science. It depends on more than just the site geometry, soil profile, and groundwater elevation. It also depends on the power, amplitude, frequency, etc. of the vibration source. When sheeting or casings will be installed near existing structures, vibratory hammers must not be used unless it can be shown that the risk of damage is low and the consequence of

damage would be minor and corrected by the contractor.

Past MDOT experience indicates that the risk of damage is particularly high when:

- Sheet piling or casings are vibrated immediately adjacent to existing structures.
- Sheet piling or casings are vibrated in very loose to moderately compact silts and sands-especially when saturated.
- Large and powerful vibration sources are used.

The risk of damage decreases:

- In homogenous clay soils
- With distance between the vibration source and the existing structure.
- With small vibration sources

Please share this construction advisory with local agencies within your jurisdiction.